

CLAIMS

What is claimed is:

1. A method for forming microparticles comprising the steps of:
 - a) directing microdroplets of a mixture comprising a biocompatible polymer, a solvent for the polymer and a protein, peptide or small molecule, into a freezing section containing a liquefied gas, whereby the microdroplets freeze; and
 - b) contacting the frozen microdroplets in an extraction section with a liquid non-solvent to extract the solvent into the non-solvent thereby forming said microparticles; wherein the freezing section and extraction section are separated, and the non-solvent is in the liquid state throughout the method.
2. The method of Claim 1, wherein the biocompatible polymer is biodegradable.
3. The method of Claim 2, wherein said biocompatible and biodegradable polymer is selected from the group consisting of poly(lactide)s, poly(glycolide)s, poly(lactide-co-glycolide)s, poly(lactic acid)s, poly(glycolic acid)s, polycarbonates, polyesteramides, polyanhydrides, poly(amino acids), polyorthoesters, polycaprolactone, poly(dioxanone)s, poly(alkylene alkylate)s, polyurethanes, blends and copolymers thereof.
4. The method of Claim 3, wherein the polymer is a poly(lactide-co-glycolide).
5. The method of Claim 1, wherein the temperature of step (b) is lower than the temperature of step (c).
6. The method of Claim 1, wherein the liquefied gas is sprayed into the freezing section.

7. The method of Claim 1, wherein the frozen microdroplets are collected at the bottom of the freezing section and directed into the extraction section.
8. A method for forming microparticles comprising the steps of:
 - a) directing the microdroplets of a mixture comprising a biocompatible polymer, a solvent for the polymer and a protein, peptide or small molecule, into a freezing vessel containing a liquefied gas, whereby the microdroplets freeze; and
 - b) contacting the frozen microdroplets in an extraction vessel with a liquid non-solvent to extract the solvent into the non-solvent thereby forming said microparticles; wherein the freezing vessel and extraction vessel are separated, and the non-solvent is in the liquid state throughout the method.
9. The method of Claim 8, wherein the biocompatible polymer is biodegradable.
10. The method of Claim 9, wherein said biocompatible and biodegradable polymer is selected from the group consisting of poly(lactide)s, poly(glycolide)s, poly(lactide-co-glycolide)s, poly(lactic acid)s, poly(glycolic acid)s, polycarbonates, polyesteramides, polyanhydrides, poly(amino acids), polyorthoesters, polyacetals, polycyanoacrylates, polyetheresters, polycaprolactone, poly(dioxanone)s, poly(alkylene alkylate)s, polyurethanes, blends and copolymers thereof.
11. The method of Claim 8, wherein the polymer is a poly(lactide-co-glycolide).
12. The method of Claim 8, wherein the temperature of step (b) is lower than the temperature of step (c).
13. The method of Claim 8, wherein the liquefied gas is sprayed into the freezing vessel.

14. The method of Claim 8, wherein the frozen microdroplets are collected at the bottom of the freezing vessel and directed into the extraction vessel.